COOPERATIVE GRANGE LEAGUE
FEDERATION ELEVATOR
(Wheeler Elevator)
(GLF Elevator)
385 Ganson Street
Buffalo
Erie County
New York

HAER No. NY-247

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PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

COOPERATIVE GRANGE LEAGUE FEDERATION ELEVATOR
(Wheeler Elevator)
(GLF Elevator)
HAER No. NY-247

Location: 385 Ganson St., Buffalo, Erie County, New York

Date: Elevator "A": building permit application March 18, 1941; approved March 31, 1941
Elevator "B": building permit application March 9, 1909; approved April 14, 1909; completed November 1909
Elevator "C": building permit application May 9, 1936; approved June 19, 1936

Designer: Elevator "A": A. E. Baxter Engineering Company
Elevator "B": H. R. Wait
Elevator "C": A. E. Baxter Engineering Company

Builder: Elevator "A": James Stewart Company
Elevator "B": Monarch Engineering Co.
Elevator "C": Possibly Hydro Construction

Status: Elevator "A": Derelict
Elevator "B": Not in use
Elevator "C": Derelict

Significance: The grain elevators of Buffalo comprise the most outstanding collection of extant grain elevators in the United States, and collectively represent the variety of construction materials, building forms, and technological innovations that revolutionized the handling of grain in this country.

Project Information: The documentation of Buffalo's grain elevators was prepared by the Historic American Engineering Record (HAER), National Park Service, in 1990 and 1991. The project was co-sponsored by the Industrial Heritage Committee, Inc., of Buffalo, Lorraine Pierro, President, with the cooperation of The Pillsbury Company, Mark Norton, Plant Manager, Walter Dutka, Senior Mechanical Engineer, and with the valuable assistance of Henry Baxter, Henry Wollenberg, and Jerry Malloy. The HAER documentation was prepared under the supervision of Robert Kapsch, Chief, HABS/HAER, and Eric DeLony, Chief and Principal Architect, HAER. The project was managed by Robbyn Jackson, Architect, HAER, and the team consisted of: Craig Strong, Supervising Architect; Todd Croteau, Christopher Payne, Patricia Reese, architects; Thomas Leary, Supervising Historian; John Healey, and Elizabeth Sholes, historians. Large-format photography was done by Jet Lowe, HAER photographer.

Historians: Thomas E. Leary, John R. Healey, Elizabeth C. Sholes, 1990-1991

This is one in a series of HAER reports for the Buffalo Grain Elevator Project. HAER No. NY-239, "Buffalo Grain Elevators," contains an overview history of the elevators. The following elevators have separate reports:

NY-240 Great Northern Elevator
NY-241 Standard Elevator
NY-242 Wollenberg Grain & Seed Elevator
NY-243 Concrete-Central Elevator
NY-244 Washburn Crosby Elevator
NY-245 Connecting Terminal Elevator
NY-246 Spencer Kellogg Elevator
NY-247 Cooperative Grange League Federation
NY-248 Electric Elevator
NY-249 American Elevator
NY-250 Perot Elevator
NY-251 Lake & Rail Elevator
NY-252 Marine "A" Elevator
NY-253 Superior Elevator
NY-254 Saskatchewan Cooperative Elevator
NY-256 Urban Elevator
NY-257 H-O Oats Elevator
NY-258 Kreiner Malting Elevator
NY-259 Meyer Malting Elevator
NY-260 Eastern States Elevator

In addition, the Appendix of HAER No. NY-239 contains brief notations on the following elevators:

Buffalo Cereal Elevator
Cloverleaf Milling Co. Elevator
Dakota Elevator
Dellwood Elevator
Great Eastern Elevator
Iron Elevator
John Kam Malting Elevator
Monarch Elevator
Pratt Foods Elevator
Ralston Purina Elevator
Riverside Malting Elevator

The Wheeler Elevator, the oldest extant structure at the Grange League Federation (GLF) complex, was constructed during the 1909 building season on the site of the former wood elevator bearing the same name. The elevator was complete and operational by November of the same year. The structure was built by the Monarch Engineering Company of Buffalo to the design of the company engineer, H. R. Wait. Basement and bin walls are of concrete, while the gallery, with its distinctive pitched monitor roof, is of structural steel. A fixed marine tower of structural steel and corrugated iron is incorporated within the workhouse at the eastern end of the building.[1]

Conventional form work was employed in the construction of the basement, but the bins were slip formed. The precise jacking arrangements are not known. The structure rose at a rate of 4' per day, with the bins reaching their full height after twenty days of continuous pouring. The estimated cost of construction (excluding plant) was $148,000. Storage was provided at a cost of 21 cents per bushel.

The fifteen main cylindrical bins, eight interspace bins and ten outerspace "pocket bins" provided a storage capacity of 700,000 bushels. The elevator was the first in Buffalo and one of the first in America to feature such outerspace bins. The main bins are cylindrical with an inner diameter of 25' and are arranged in three rows of five bins, on centers 25'-10" in diameter with all bins in tangential contact. The interspace bins occupy the spaces enclosed by the main bins and form two rows of four bins. The outerspace bins occupy all the pockets between the outer wall of main bins except those of the eastern end wall, where the presence of the marine tower precludes this use. The outerspaces are relatively small, the bin wall consisting of something less than one-sixth the circumference of the main bins. All bins are 84' deep.

The bin walls are 8" thick and 12" thick at the tangential contacts. The contact thickening extends for 5' either side of the bin center lines. Reinforcing consists of twenty-eight rectangular bars of unknown dimension in each main bin and five similar bars in every outerspace bin wall. The verticals are set on 3' centers. Some of the verticals were probably used as jacking rods to raise the forms. Horizontal reinforcing consisted of seventy-nine graduated rectangular bars in 12" courses. The dimensions of the bars are unknown.

The open bin tops are a unique example of this type of construction in a Buffalo concrete elevator. Although several large concrete elevators built in the first decade of the century had no bin floor, the reasons for this arrangement are unclear.

It was claimed that extra storage could be gained by heaping the grain above the top of the bin walls within the monitor. Such extra storage was achieved at the expense of increased dust levels and a corresponding likelihood of explosion. Following the catastrophic explosion at the similarly constructed Chicago and Southwestern Elevator, this design feature appears to have been abandoned.

The bottom of the main bins consists of an eight-sided flat plate steel hopper which extends across the full width of the bins. The sides are at 45° angles to a central draw-off spout. The interspace bins have four-sided flat plate hopper bottoms, and the outerspace bins three-sided plate hoppers. In both cases, they extend across the full area of the bin. The bin walls are supported by an octagonal network of hopper (basement) beams arranged so that all parts of the bin wall rest directly on the beam system without a bin slab. The steel hoppers are also supported by this network of beams. The interspace bins are supported by the diamond-shaped network of beams formed at the intersection of four adjoining octagonal networks. In order to provide support for the outerspace bins, a beam links the outer beam of the exterior octagonal networks to form a continuous beam around the entire structure. Such an arrangement provides a triangular beam network below the outerspace beams. The hopper beams are 2' x 3'-9", with the exception of the 1'-1" x 3'-9" outer beam.

In order to provide a full basement, the beam network is raised on rectangular pillars located at every angle change in the octagonal hopper beam network. Each octagon is supported by eight pillars. The columns are 11'-3" high which, combined with the hopper beam depth, provides a 15' high basement below the base of the bin wall. However, the breadth and angle of the hopper bottoms are such that only 5'-2" remains below the draw-off spout. The columns are 3'-9" x 2'-9", with the exception of those supporting the outer beam, which are 2'-9" x 2'-6". The details of the reinforcing of pillars and beams are unknown. The exterior walls are straight with a panelled effect achieved by an infilling of rusticated concrete block between exterior pillars. The rusticated panels are pierced by upright windows. The structure rises from a basement slab of 1,500, 45' wood piles.

Although the bins are open-topped, some of the outer rows of bins have flat concrete roofs, as this area falls outside the pitched gallery roofing. The gallery, of monitor form with the clerestory rising to 120' above grade level, is also of structural steel clad in corrugated iron. The combined marine tower and workhouse abutting the eastern elevation is of the same materials. It has a pitched roof and rises to 150' above grade. No railroad loading shed was provided because cars were loaded in the open on two tracks to the south of the structure. The date of the three-track loading shed at the southeast end of the building is not known, although it may be contemporaneous with the 1929 mill.

The main impetus behind the extensive development of the site came in 1929, when the Cooperative Grange League Federation (GLF) purchased the Wheeler Elevator. Almost immediately, the company set about constructing a large modern feed mill immediately to the west of the elevator. The structure, built to the design of the A. E. Baxter Company, was executed in reinforced concrete with brick infill panels. It is of six stories with two elevator towers sporting castellated parapets that rise above this level on the northern elevation. The mill's eighty rectangular and square bins rise above the second story and are supported on foundation pillars. To accompany these developments, a reinforced concrete drier house and a structural steel railroad loading shed were provided in the same year. The drier house lies immediately to the northwest of the Wheeler Elevator and the track sheds abut the southern walls of both elevator and mill.

The small Wheeler Annex, known after 1941 as GLF "C," was constructed at the site in the 1936 season. As with all developments carried out by GLF, the design work was completed by the A. E. Baxter Company. The elevator is built entirely of concrete and is of the bin wall basement design which permits slip forming to take place from the foundation slab upwards. It was completed at an estimated construction cost of $50,000, providing storage at a cost of 29 cents per bushel.

The elevator has a capacity of 154,700 bushels stored in six main bins of 21' inner diameter. These bins are arranged in two rows of three bins, a configuration that provides two interspace bins. The bin walls rise directly from the foundation slab to a height of 99'-9". However, the bins are shallower as the bin bottoms are raised within the bin walls to provide a full basement. Except for the westernmost row of bins, which is slightly shallower in order to accommodate the transfer conveyors to the main storage house, the bins rise 85' from the ring girder. The bins have transverse tangential contacts and longitudinal linkwall contacts. GLF "C" was the first bin wall basement style of elevator in Buffalo to introduce the link wall contact as a means of increasing the volume of storage in the interspaces. The tangential contact thickening extends 4'-9" either side of the center line, while the straight link walls are 2'-3" long. The bin walls are 8" thick and have a minimum thickness of 10" within the contact thickening and the link walls.

The first 22' of the bin walls, including the 13'-9" of wall below the top of the ring girder, is constructed of 1:1-1/2:3 mix concrete like the rest of the foundation works. Vertical reinforcement consists of deformed round rod of intermediate grade new billet steel. The jacking rods are of 1" round hard grade, non-deformed new billet steel. The verticals are centered 3-1/2" from the outer wall surface. The horizontal reinforcing is of round, deformed rod of intermediate grade, arranged in graduated sizes at fixed course intervals. The coursing interval is 12" and only two rod sizes are employed.

The main bin bottom hoppers are of plate steel, conical in shape and extending to the full width of the bin. They are raised within the bin walls on radially arranged pillars in a form that is a derivative of Budd's patent. The hoppers are at 45° angles. The interspace bin bottoms are comprised of an angled concrete slab discharging centrally into a four-sided flat plate hopper. The hopper is supported on a network of beams that forms a square and is tied into the main bin walls. The main bin bottoms are supported on a twelve-sided concrete ring girder raised on six radially arranged basement pillars. The pillars stand independently of the bin walls. Although the ring girder abuts the inner face of the bin wall, it is not a structurally integral part of the wall. The ring girder is 3'-6" x 3'-6" and is reinforced vertically by seven straight non-trussed rods within each of the twelve faces. The rods, arranged 2" x 1/2" at the top and 1" x 1/2" on each side, are bound by 1/2" hooped rods on 16" centers. The supporting pillars are 10'-6" high and 1'-2" x 1". The basement is lit by two upright windows that pierce the exterior wall of every bin cylinder below the ring girder.

The structure is built on 433 wooden piles 55' deep and arranged to bear 18-1/2 tons each. The piles are arranged on 2'-6" centers, but piling is absent below the central area of each bin. The 3' thick foundation slab capping the piles thins to 1' where piles are absent. The slab is reinforced by a complex system of rods placed at different levels: a main grid of 1" square bars over the piled areas, a radial system of round rods below the exterior bin walls, a diagonal grid of 1" round rods below the interspaces, and a grid of round rods in that part of the slab below which piles are absent. Fourteen feet of gravel hardcore is laid upon this slab, which supports a 4" floor. The radial pillars rest directly on the foundation slab. A conveyor tunnel runs between the annex and the Wheeler mainhouse and is located on the western side of the annex. The gallery consists of a two-story monolithic concrete structure inset from the line of the exterior bin walls. A steel gallery provides the conveyor link to the main Wheeler storage house.

In addition to the Wheeler Annex, a substantial two-story concrete and brick panelled warehouse and railroad loading shed was added north of the main mill in 1936. Other substantial additions to the complex included an additional two-story warehouse between the mill complex and the No. 1 Warehouse and a set of three large steel molasses tanks to the north. The tanks were 60' in diameter and similar to the large tanks at the Great Eastern Elevator. They also resembled those added to the Monarch and Electric elevators, which were constructed upon concrete foundation dishes. The dates of these additions are unknown.

The final phase of elevator construction at the site occurred in 1941 with the construction of The GLF "A" Elevator. It was to be the largest in the complex, and upon its completion the other elevators were redesignated alphabetically, according to their capacities. The GLF "A" was built by the James Stewart Company to the design of A. E. Baxter Engineering. The entire work is in concrete and of the bin wall basement design, which permitted slip forming to take place from the foundation slab. In addition to the main storage, both east and west ends feature integral workhouses. The eastern workhouse is a substantial affair with storage provided in both square and rectangular bins. The tallest such structure in Buffalo at 205'-3". The elevator was completed at an estimated cost of $400,000.

The elevator's capacity is 1,000,000 bushels. The bulk of this storage is provided in the main storage, which consists of cylindrical bins arranged in three parallel rows of twelve bins each. This arrangement provides for twenty-two interspace bins, arranged in two rows of eleven. The bins are 19'-8" in inner diameter, rise 108' from the foundation slab and are 92' deep from the top of the ring girder. The interspace bins are shallower, as the hoppering is raised higher in the structure to permit spouting to the conveyors that run along the center lines of the cylindrical bins. Additionally, the east workhouse provides storage in twelve 9'-6" square bins and three 9'-6" x 14'-6" rectangular bins with a depth of 91'. All cylindrical bins are in tangential contact. The contact thickening extends 4'-9" either side of the longitudinal center line and 4' either side of the transverse center line.

The cylindrical bin walls are 8" thick, the minimum thickness within the tangential contacts. The bin walls are of 1:2:4 mix concrete except for the first 17' which is of 1:1-1/2:3 concrete. The verticals are round, deformed rod, of hard grade new billet steel. No ordinary verticals are within the area of tangential thickening. The verticals are placed at different intervals within the 8" bin walling--on 2' centers for the interior walls and on 3' centers for the exterior walls--giving the interior walls twelve verticals and the exterior eight. The jacking rods, deployed in 4' lengths with sleeve connections, are of 1" deformed rod of hard grade, new billet steel. Eight jacking rods are placed equidistantly on 7'-6" centers about the circumference of the wall, including one at the center of every tangential contact. The jacking rods do not form part of the spacing interval of the ordinary verticals but rather augment the amount of vertical steel in the bin walls. All verticals are centered 3-1/2" from the outer surface of wall. The horizontal reinforcing is of round, deformed rod of intermediate grade, new billet steel. It is placed at 12" fixed course intervals with graduated rod dimensions. From the base upwards it consists of eighty-three courses of rod, followed by twenty-five courses. The horizontals are wired to the outside of the verticals.

The main bin bottoms are comprised of conical steel hoppers extending to the full width of the bin and supported by an annular concrete ring girder. The hoppers are angled at 55°, rather steeper than the more usual angle of 36-40°. Such an arrangement aided the flow of some of the materials used in feed manufacture, particularly brans. The interspace hoppers are of flat steel plate set within an inclined concrete slab, both being supported by a square frame of concrete beams tied to bin walls.

The hoppers are supported on an annular reinforced concrete ring girder abutting, but not structurally tied to, the interior bin wall. The girder has a twelve-sided interior face, and each face is reinforced with eight straight, non-trussed hard steel rods. Two rods are close to the bottom face and the remainder distributed towards the top of the beam. The beam is 3'-6" x 2' and roughly triangular in cross section so that the conical hopper may rest within it. The ring girder is raised inside the bins and rests upon six free-standing radially-arranged basement pillars which are 13'-5" high and measure 1'-4" x 1'-2". The vertical elements of the pillars are bound by spiral reinforcing.

All bin walls extend to the basement slab and are pierced longitudinally by openings for the conveyors, diagonally for personnel access from one cylinder to another, and on every exterior cylindrical wall by two upright windows. This arrangement provided 12'-9" of basement headroom measured from the floor slab to the ring girder. All works within the basement are of 1:1-1/2:3 concrete, although the basement bin walls were slip formed directly from the foundation slab. When the bin walls had risen above the basement level, the pillars and ring girders were constructed using conventional form work. Each pillar was poured in a single lift.

The elevator sits on concrete caissons 36" in diameter. These support a polygonal network of reinforced concrete foundation beams 3' deep and from 3' to 4'-9" wide. The structure incorporates a 9" foundation slab, above which is a 5" gravel bed with a 4" floor reinforced by a grid of 1/2" round bar at 15" intervals. The works are of 1:1-1/2:3 concrete reinforced with deformed bar of intermediate grade steel.

The bin floor is of non-monolithic reinforced concrete. Each bin has its own discrete top, a design feature introduced by the Baxter Company after the explosion at its Eastern States Elevator in 1937. The company anticipated that individual bin tops would act as "safety valves" in the event of an explosion within the bin. Fortunately, the effectiveness of this safety feature never required practical testing. Despite these individual bin tops, the outer portion of the bin floor is of typical Baxter design. The floors extend beyond the bin lines to form overhanging eaves, with corbel details formed from the bin floor beams. The bin floor is enclosed within a single-story gallery of reinforced concrete. This feature is typical of later galleries and attempts to provide maximum ventilation to the area.

Monolithic concrete workhouses are located at both the eastern and western ends of the structure. These structures were slip formed from the foundations simultaneously with the main cylindrical storage bins. The western workhouse is 18' x 55' and 197' tall, lacks storage capacity and contains an elevator leg, stairs, and a single set of weighing equipment. The eastern workhouse, 42' x 61'-8" and 205' tall, is equipped with a full compliment of bins. The 92' deep bins are arranged in a 4 x 5 configuration. The outer rows of four consist of 14'-6" x 9'-6" rectangular bins, while the inner three rows are 9'-6" x 9'-6" square bins. However, only three of the rectangular spaces are designed for grain storage, the remainder accommodating three elevator legs, a personnel elevator and stairways. A full basement of 16'-2" is provided.

The bins are raised on a central row of 4'-4" square longitudinal pillars and supported on three sides by the straight exterior walls and on the fourth by substantial pilasters incorporated into the cylindrical basement bin walls. The basement structure provides support for a 10" thick bin slab, with conventional mortar-faced slag concrete hoppering above. A sub-basement containing both the leg boots and tunnel conveyors from the adjoining railroad shed is provided at grade level.

Both interior and exterior bin walls are 8" thick. The external wall thickens to 12" or 15" to form an external pier 36" wide at the intersection of the exterior bin wall with every transverse interior bin wall and every other longitudinal interior bin wall. The pier extends from the basement slab to the full height of the workhouse. The structural elements of pilaster and bin wall form, respectively, the piers and panels that are often a characteristic of the rectangular-binned elevator. Internally, the corners of all bins thicken to form triangular fillets. The bins intersecting at piers or above basement columns have the largest fillets. The combination of four fillets at the intersection of every internal bin creates square columns that rise the full height of the bins.

The arrangement of reinforcing within the walls is entirely different from that found in the cylindrical bins. All walls have a double row of reinforcing placed 2-1/2" behind the face of each side of the wall. Each row is independent of the other and consists of a system of horizontals tied to verticals. Within any one wall, both rows have the same components, arranged so that the laps between bars are staggered. Within the interior bin walls, the verticals are round intermediate grade steel placed on 3'-6" to 5' centers. Each wall of a square bin has verticals 2' from its corners, while the long walls of the rectangular bins have four sets of verticals arranged so the spacing increases from 3'-6" toward the corners to 5' toward the centers. The verticals in the exterior walls are on 18" centers. Where the walls thicken to form pilasters, square-section hard grade vertical steel is specified. Similarly, where internal columns are created by the combination of four bin corner fillets, square-section hard grade horizontal steel is specified.

The horizontal steel within the columns and piers is graduated. Within the pilasters, the dimensions of bar typically diminish above the basement slab, ranging from 1-1/4" bar to 1" bar. Within the columns, 1-1/4" and 1" bars are used. The number of these verticals diminishes with height, from nine to ten rods within the piers at the base to eight at the top of the bins. Within the central columning, the twenty-two verticals at the base are reduced to eleven at the top of the bins.

In contrast, the horizontal reinforcing system has neither graduation of bars and rods nor variation in their spacing. Throughout the square bin walls, the horizontals are of 1/2" square bar placed in 12" courses. However, the first 11' of basement walling is 1/2" round rod. In the long walls of the rectangular bins, an additional system of round horizontals is placed between every course of 1/2" bar, giving a 6" coursing interval to the full height of the bin. The additional reinforcing reflects the greater moments generated within these walls. The horizontal steel extends uninterrupted through pilasters and columns. Corner bars are placed across the diagonals of the column fillets. The vertical steel of the columns and pilasters is tied by horizontal hoops of 1/2" rod at 12" or 6" intervals. However, the basement pillars are bound by spiral steel on a 3" pitch. The jacking rods positioned centrally within the walls are of 1" hard steel.

Above the bin floor, the east workhouse features in ascending order, a distribution floor, a scale floor, a garner floor and a head floor. The west workhouse lacks a distribution floor. All weighing hoppers are steel. The floors are supported on a rectangular network of beams reinforced with trussed steel. The beams are 16" wide, with the depth varying according to the load carried. Those of the distribution floor are 30", the scale floor 60", the garner floor 50" and the head floor 30". The wall piers and central pillars that extend above the bin floor and support the workhouse floor beams thin to an overall width of 36". Monolithic concrete panels are between the pilasters.

Both workhouses were slip formed and raised simultaneously with the main storage, a process that required a complex series of choking, filling and cutting off operations. A set of forms suitable for the forming of the bins, pillars and pilasters would have been constructed on the foundation slab. During the construction of the basement, most of the form work would have been choked off; only those forms required to form the exterior wall, pilasters, and central row of pillars would have received concrete. The jacking rods unsupported by concrete would have had to be propped throughout this process. All the forms were activated to form the network of beams below the bin slab. The bin slab may have been added monolithically by form work carried between the wall forms. Slip forming would have continued to the bin floor without further modification of the form work.

At this point, substantial modification of the forms was carried out to produce the upper workhouse beam and pillar system. The forms responsible for the outer walls and piers required no modification, as these features are carried to the full height of the structure. The forms were either completely rebuilt or modified, depending on the original construction. The diminishing width of the pillars and pilasters was accomplished by the insertion of fillers at the appropriate location in the original forms. As the network of upper workhouse beams are all coincident with part of the bin wall, the original forms could be used for their construction. However, as they are twice the thickness of the bin walls, the parts of the forms used for beam construction would have been constructed to an inner width of 16", reduced to 8" by the insertion of fillers when constructing the bin walls.

At the bin floor level, the fillers were removed and those parts of the bin forms not required for upper workhouse construction cut off. After this modification, slip forming continued. The beam forms were choked off and reactivated at the appropriate levels in the structure. The jacking rods below this section of the form work were supported by the floor level previously poured. The floor slabs may have been poured monolithically, but, more likely, were poured in conventional form work after the passing of the slip forms.

A structural steel and corrugated iron three-track railroad adjoining the eastern workhouse shed completed the 1941 works. The site achieved its present extent in 1961, with the addition of the pellet mill to the east of the main mill. This concrete structure incorporates a series of small square bins with 4" walls at intermediate level.

BUSINESS HISTORY

The large Agway Elevator complex on Ganson Street bordering the Buffalo River occupies the former site of a wooden grain elevator built in the nineteenth century. The current concrete elevator complex was begun in 1909 to replace a wood structure that had burned in 1906 leaving the property vacant.[2]

The early twentieth-century owners of both the wooden and the new concrete elevator were Wheeler family members. Albert J. Wheeler, family patriarch, was president of the Western Savings Bank and owner of a small business with a separate elevator known as the Monarch. This operation, sited alongside rail lines and the Evans Ship Canal on Perry Street, had sustained the family business after the first Wheeler Elevator burned, but the family was eager to rebuild the riverside property.

On February 25, 1909, three family members incorporated the Wheeler Elevator Company with a capital of $200,000; Albert J. Wheeler, his wife Kate and son George Clinton Wheeler served as the sole owners and directors. A week later, the company announced plans to rebuild the existing site with a new elevator much larger than the 400,000-bushel wooden structure. The concrete elevator, to be situated upriver from the Kellogg Elevator, would be fireproof and, it was projected, would have a capacity of 1.7 million bushels. The finished elevator had an actual storage capacity of 700,000 bushels but in all other ways met the company's expectations.[3]

Wheeler Elevator secured a mortgage to cover construction. It borrowed $200,000 from Fidelity Trust Company of Buffalo, presumably to avoid a conflict of interest in borrowing from Western Savings. A twenty-year mortgage, secured with bonds issued at $1,000 each, was to cover all aspects of construction and outfitting on the 200' x 65' riverfront lot. Included in the costs were the elevator structures "and all and singular the engines, boilers, shafting, belting, machines, machinery, tools and appliances of every nature used or provided in such elevator...."[4]

The Wheeler Elevator opened in late 1909 with Albert J. Wheeler as President and George E. Pierce as manager. Pierce was also owner of the wooden Evans Elevator which adjoined the Monarch Elevator and operated cooperatively with the Wheeler property. By 1915 Pierce managed all three elevators but had no ownership interest in the Wheeler facilities.[5] The enterprise was short-lived; in January, 1917, just as demand for storage and transfer capacity was escalating due to supply pressures from wartime grain requirements, the Wheeler Elevator Company dissolved. In early February, the now-defunct company "sold" the property to Albert and George. Albert was to hold two-thirds interest and George the remaining one-third of "the elevator and structures" and of "all and singular the engines, boilers, shafting, belting, machines, machinery, pulleys and tools" used in the elevator. Clearly, the property was to continue operation, but as a privately held unincorporated business. It is not clear if the company defaulted on the original mortgage, but presumably the Wheelers were responsible for the original debt.[6]

In 1920, a scandal briefly touched the Wheelers when their associate and manager, George E. Pierce, was indicted with first degree grand larceny. He was accused of depriving his own Evans Elevator Company and the Manufacturers & Traders Bank of over 16,000 bushels of oats. While Pierce's action in no way affected the Wheeler elevators, the company began to falter in the public eye. It was forced into a boundary line agreement to reconfirm its ownership of the elevator property. Shortly thereafter, Albert Wheeler died, leaving wife Kate and son George to operate the properties.[7]

In May, 1926, Mrs. Wheeler and George Wheeler, along with Edward E. Coatsworth, all executors of Albert J. Wheeler's estate, sold two-thirds of the Ganson Street property to Transit Forwarding Company for $266,666.67. The sale transferred all improvements, including the elevator and its machinery, to Transit along with the right to engage in the elevator business and to use the name "Wheeler Elevator." In a separate deed, George C. Wheeler transferred the remaining one-third of the property to Transit.[8]

Transit Forwarding Company had been incorporated in March of 1923 to "buy, sell, convey" real and personal property "including grain elevators and the appurtenances thereto" as well as to buy and sell grain and other goods. It was a modest operation capitalized at only $20,000 held among three directors, Daniel Sprissler, Edgar B. Black and Abraham B. Black. The Blacks were longtime grain merchants associated with Charles Kennedy &

Company who later became affiliated with Superior Grain Elevator. Edgar Black would become a Superior director in the 1930s.[9]

Transit Forwarding's hold over Wheeler Elevator lasted less than two years. In February of 1928, Transit sold the elevator property to the Western Elevating Association (WEA) for $750,000, yielding a tidy profit to Transit. Ironically, the president of WEA was George E. Pierce, survivor of grand larceny charges, who once again had an interest in the Wheeler Elevator. Western Elevating was the Buffalo elevator owner's pool that lobbied for the grain handling industry in western New York. Its intervention in the sale indicated the importance of keeping Wheeler operating as a contributing part of the Buffalo grain trade. However, as an advocacy organization, WEA was not in a position to run the elevator for a prolonged period, and at the first opportunity, WEA sold the Wheeler to the Cooperative Grange League Federation Exchange, a farmer's cooperative based in Syracuse, New York.[10]

In 1920, while the Wheelers were still actively controlling the Ganson Street Elevator, a new organization was formed that would have a significant impact on the Buffalo grain trade. On June 22 of that year, four existing farmer's associations came together to incorporate the Cooperative Grange League Federation Exchange. The constituent bodies included the New York Grange, Order of Patrons of Husbandry, the Dairymen's League Cooperative Association and the New York State Federation of County Farm Bureau Associations. The group also proposed to include any and all willing unnamed farmers and producers in New York and adjacent regions.

The purpose of the new organization was to purchase the assets, property, and business of a going concern known as the New York Grange Exchange. The Exchange's business was to produce, manufacture, purchase, store, and distribute virtually all articles required by farmers, both in their production and household consumption. Beyond that major purpose, the Exchange was created to acquire property, to lend money, to promote agricultural improvements through the acquisition of copyrights and patents, and to promote the benefits of cooperation.[11] The firm was incorporated with 200,000 shares of stock issued at $5.00 per share. There were to be nine directors, three of whom would be from the New York Grange, three from the farm bureaus, and the final three from among the Dairymen, Grange, and farm bureaus.[12]

Shortly after GLF was founded, the directors established a second company called Producers Warehouse. This company was more narrowly defined in its purposes, with operations restricted to grain elevating, storage, and milling coupled with property acquisitions germane to those functions. Producers Warehouse was incorporated December 16, 1920, for $450,000 issued in 24,000 shares of preferred and common stock. It functioned as the property subsidiary of GLF which was a holding company like many other non-cooperative corporations. Although GLF bought the Wheeler Elevator from the Western Elevating Association in February, 1929, Producers Warehouse operated the site for the first few years. In 1930, Producers Warehouse was supplemented by the formation of a new holding company, Cooperative GLF Holding, which assumed control over all operations.[13]

Even before the purchase of the Wheeler, GLF was already a presence in Buffalo. It owned and operated two feed mills in the city, and, in 1922, its Niagara Street feed mixing operation produced 43,800 tons of dairy and poultry feed. By 1929-30 that site was yielding 547,000 tons. The Ganson Street site provided an additional 750,000 bushel storage capacity.

Shortly after purchasing the Wheeler, GLF added a feed mill which was completed in 1930. This single operation yielded $26.5 million in feed and fertilizer products distributed in over 650 outlets--including ninety cooperatives and over 500 dealers and private stores. The Buffalo River site was an enormous boon to GLF. A decade later, GLF had survived the Depression to produce 100,000,000 bags of animal feed per year with gross sales of $30 million. The plant moved out 100 railroad cars per day loaded with cattle, hog and poultry feed. The company's business was so steady that it was virtually immune to the economic variations present in all other industries; GLF employees received annual rather than daily wages that were issued in predictable amounts, fifty-two checks per year and unemployment was virtually unknown. Costs were lowered by increased grain handling and processing efficiency so that wages could be maintained and even raised without increased burdens for each worker.[14]

In March, 1941, GLF announced plans for a major one-million-bushel elevator addition. The first plans had been formulated in 1936 but were not finished until 1941. The cooperative had purchased Buffalo Drydock Company land and planned to spend $2 million for both the elevator and improvements to the feed mill. The elevator was projected to have tanks 110' high occupying a base of 61' x 303'. These alone were to cost $800,000 and would more than double the plant's original capacity. The feed mill would produce goods in bulk rather than in bags and would include new railroad trackage allowing the mill to fill forty cars of feedstuff at a time, a substantial increase over the 1940s rate of fourteen cars per loading.[15]

The brilliant success of the GLF enterprise was undermined suddenly in August, 1941, not by economic hardship but by GLF's new quest to decentralize its operation. GLF had built up the Buffalo business but simultaneously developed similar smaller operations throughout New York State in "country" elevators and feed mills. As these facilities settled into their own operations, they found both local suppliers and customers who did not need to rely on the Buffalo hub.

In July, 1941, GLF temporarily ceased all production at the Buffalo plant, citing labor difficulties that had abruptly arisen for the first time that year and which, along with security issues attending protection for large-scale elevators, were seen as impediments negatively affecting wartime production. Furthermore, several of the outlying feed sites, particularly Oswego and Ogdensburg, lay alongside the St. Lawrence River. In conjunction with other Buffalo elevators, GLF had long opposed plans to improve the river by removing impediments that would open a passage to the Atlantic Ocean. Such a plan would potentially by-pass Buffalo and threaten the necessity of the capital-intensive elevator investments in the city. Suddenly, as GLF saw alternatives for itself, protection of the Buffalo port became less urgent. City officials feared increasing GLF advocacy for the seaway to improve the grange's access to foreign trade and different sources of grain supply.[16]

Despite the threats to the Buffalo operation, plans for construction of the new addition proceeded. The labor issues were settled, and neither the size and number of smaller elevators nor the opportunities afforded by the seaway project had provided GLF with viable alternatives to Buffalo. By November of 1941, the foundation for the thirty-six new bins had been laid as open steel caissons sunk to support the concrete construction. The company subsequently added office space to Elevator "A" and altered the mill to increase capacity as projected in 1941.[17]

In the midst of the GLF expansion plans, wartime pressures worked against farmers' cooperatives and all other large elevators. To facilitate the flow of grain, the Association of American Railroads had implemented an operators' distribution regulation known familiarly as the "blocked elevator rule." When a grain elevator was 75 percent full it was considered "blocked" because it was difficult for farmers to sell grain to that elevator. Elevators 100 percent full were designated "plugged." When several elevators were blocked simultaneously, each received a rail car in preference over unblocked elevators. The rule worked to the detriment of larger elevators which were given the same number of cars as small elevators but could not move as much grain. Cooperative elevators such as GLF tended to be large and were consequently emptied more slowly. Cooperative members lost their patronage dividends as grain stood idle in elevators rather than moving to market. The shortage of railroad cars persisted for several years during and after the war, but did not impel GLF to act on its potential to decentralize since grain volume could not be handled by its smaller facilities.[18]

In the early 1950s, the GLF Buffalo operation once again appeared to be booming. In 1951 the plant employed 330 men and women and produced 2,400 tons of dairy, poultry, and stock feed every day. The combined elevators had 1.75 million bushels of capacity and three liquid tanks that held 1.8 million gallons of molasses, an essential feed ingredient. Half of the plant stored grain and half by-products including linseed oil cake, brewery and distiller chaff, and other scraps, much of which came from nearby grain elevators and processors. GLF shipped sixty-five thirty-ton boxcars per day on the two Buffalo Creek Railroad spur lines and nine sidings while fifty trucks took the rest. As the feed could not be stored, production never exceeded current orders.

GLF bagged products also moved out of the plant steadily. The cooperative stopped printing product names on the bags; instead it used plain bags with only the GLF logo and added removable paper tags identifying the contents. In this way, GLF avoided back orders because there were never any bag shortages. By recycling bags and offering customers rebates for bag returns, the company kept bag costs down. Because of the continuous production flow, the plant operated five days per week with two eight- to ten-hour shifts. Weekends were used for repairs. All appeared well.[19]

Two years later, however, major changes implemented by the cooperative created a substantial labor upheaval, the first really large-scale strike in Buffalo's grain industry in years. Despite GLF's existence as a farmers' cooperative, the company behaved as any other employer with respect to its urban labor force of grain scoopers and other employees. In the fall of 1953, GLF obtained a time study that led the company to order reductions in scooper crew sizes and thus in the level of employment. After years of virtually guaranteed work and good labor-management interactions, the union rebelled at this peremptory action. Fifty-six workers who refused to work on smaller crews were fired. The risk of personal injury was the primary reason that the union feared reductions in crew size from ten to six men. Workers were reluctant to tamper with past practices calling for ten-person crews regardless of company desires to the contrary. Soon other employees joined the discharged scoopers on the picket lines. The strike lasted nearly two months before it was finally resolved by New York state and federal injunctions filed by both the company and the railroad. Although the injunctions halted the strike, they did not resolve the new farmer-labor tensions engendered by the GLF cutbacks.[20]

Despite the upheaval, operations at GLF continued relatively smoothly for the next decade. In March of 1964, however, GLF decided to expand once again. Already the largest farmer's cooperative in America, GLF proposed merging with the Eastern States Farmers Exchange, a Massachusetts-based cooperative founded in that state in 1918. The two cooperatives had sales of $308 million in 1963, which would have made them the 158th largest corporation in the nation. Both organizations were interested in expanding the range of their operations by extending processing, handling, and sales operations. To facilitate the merger, the New York State Assembly and Senate had to pass bills of authorization which were signed by then-governor Nelson Rockefeller February 17, 1964, three days before the stockholders' meeting.

The new cooperative was formally merged June 16, 1964, under the name Agway, Inc. By the time of its formal incorporation, GLF had consolidated sixty-four other independent Grange League Cooperative operations and merged them with Cooperative GLF Exchange and Eastern States. The result was a single farmers' cooperative of mammoth proportions.[21] Proposals for a new headquarters included Buffalo. In 1964 the GLF offices were located in Ithaca and the Eastern States' in West Springfield, Massachusetts, but neither of these sites was large enough for the new organization. Buffalo was eager to obtain the office since the merger would result in cutbacks in facilities for producing feed, seed and fertilizers. Although Agway promised the Buffalo plant would remain central to the company's operations, city officials wanted a greater hedge against reductions. Syracuse, the original Grange League Federation location centrally located within the expanded geographic district, finally won out.[22]

The choice of Syracuse initially made no difference to the Buffalo plant which continued to operate as before. However, in early 1974, Agway finally implemented the threat to decentralize initially proposed thirty-three years earlier. The feed division offices were moved from Buffalo to Syracuse, and the company announced the closing of the entire Ganson Street operation before the end of the year. Over 260 office and production workers were to be laid off as all feed operations were moved to Jamestown in the southern part of the state and to Batavia, about thirty miles east of Buffalo. The new decentralized facilities, serviced exclusively by truck and railroad, would not require scoopers. Other operations were to be automated, substantially reducing the number of mill employees. The new plan was to locate small production facilities so that all delivery and sales would serve farm populations within a thirty- to forty-mile radius of the mill. The Ganson Street operation was suddenly too costly for Agway goals, and the cooperative determined that even the water access for incoming grain was insufficiently significant to offset the benefits of short-haul exchanges and reduced work crews. The tension between rural farmers and urban workforces had taken its toll. Instead of a labor-intensive central feed and seed processing operations, Agway developed twenty smaller feed facilities and nineteen seed plants.[23]

The 1974 closing of Agway left the property derelict, another casualty of the changing grain trade. The riverside site was eminently desirable, but the mammoth concrete elevator structures, too costly to demolish, were a hindrance to property development. The Agway site changed hands several times before being sold for a minimal sum to its current owner, the Great Lakes Fishing Club. The massive elevators and grain mill continue to deteriorate and, after twenty years of neglect, offer no real hope for revival as a grain processing facility.[24]

MATERIALS HANDLING: HISTORY AND DESCRIPTION

Receiving by Water

In 1909 the Wheeler opened exclusively as a transfer and storage elevator. Grain was unloaded from lake vessels by a single fixed marine leg. The leg assembly consisted of belt, buckets, pulleys, and framing with associated counterweight, hoist pusher, main drive and auxiliary motors. These mechanisms were contained in a steel-frame tower/headhouse adjacent to the dock and integral to the reinforced concrete storage section. Initial estimates placed the handling capacity of the marine leg at 18,000 bu./hr.

Other equipment in the workhouse for handling instore grain from vessels included a 200-300-bushel Buffalo receiving scale with distributing spouts to storage bins, belts or cleaning machinery; a pair of lofter legs was also provided to handle rail receipts and outstore shipments. When additional bins were later constructed immediately to the north (Elevator "C"), water-borne grain could be transferred from the Wheeler headhouse via conveyor gallery to the bin floor of the new annex for further distribution. The steel-frame monitor extending west from the headhouse over the storage bins housed three parallel Weller conveyor belts with movable trippers for discharging grain into the proper storage tanks. The capacity of the house lofters at

15,000-18,000 bu./hr. was proportional to the vessel unloading rate and the speed of the conveyors.

Subsequent extensions of storage capacity on the site by the Cooperative Grange League Federation Exchange (GLF) in 1936 (Elevator "C") and 1941 (Elevator "A") did not include additional marine receiving capacity. As late as 1951, a local newspaper noted that "...few ships are handled because so many products must be stored there is no room for large single quantity shipments."[25] In the years following World War II, the vessel unloading rate sank to 12,000 bu./hr. However, during the mid-1950s, GLF upgraded the original marine leg designed by Monarch Engineering.

In one of the firm's last major projects on the Buffalo waterfront, Baxter Engineering redesigned the marine receiving equipment at the Wheeler (since renamed Elevator "B"); the result was one of the most efficient handling units of its type at any local elevator.[26] Published sources indicate a nominal unloading rate of 20,000 bu./hr. from the early 1960s through 1971 and, presumably, through the shutdown of the Agway complex in 1974. Potential connections between modernization of the marine unloading equipment and a grain scoopers' walkout in 1953 remain unexplored.[27]

Receiving by Rail

GLF's construction of a feed mill and expanded storage capacity adjacent to the Wheeler established land transportation as the primary mode of bringing grain and other ingredients onto the site.[28] The Wheeler's initial car unloading equipment, located at the north side of the elevator, consisted of a single receiving pit with a car puller for spotting boxcars over the track grates and the customary pair of power shovels for removing the contents. Grain would then presumably have been transferred via a belt conveyor from the car pit to the headhouse for elevation via one of the lofters and instore weighing. If preliminary cleaning was required, which was ordinarily the case for grain carried by rail, a 7,000 bu./hr. receiving separator was provided in the workhouse.

Through the 1920s the Wheeler's rail receiving capacity was pegged at approximately 5,000 bu./hr. The addition of the feed mill and Elevator "C" appears to have resulted in relocation of the original car unloading facilities. With rail access to the north side of the Wheeler blocked off, a two-story, three-bay reinforced concrete track shed was added on the south side of Elevator "B"; both shipping and receiving were apparently handled in the new structure.[29] When Elevator "A" went into service, this facility was probably reconfigured for loading out. Additional cleaning equipment, including a corn drier and an oat clipper, also appears to have been added by the late 1930s.

Rail receiving capacity at Elevator "A" was substantial. One of GLF's major objectives in doubling the storage space available on its Ganson Street site was to provide for bulk handling of feed ingredients such as bran, middlings and soybean meal in addition to grain; previous practice had been to handle feed ingredients in bags.[30]

A four-track car shed, located on the south side of Elevator "A's" east workhouse, contained the car unloading equipment. Boxcars were spotted by wire-cable car pullers driven by a 100 hp motor. Once winched into position over the four receiving pits, cars were emptied by manually-operated power shovels featuring special Cooperative scoops. The shovels were powered by a twenty-five hp motor with Morse flexible coupling and gear reduction; the drives for the shovels serving the various pits were housed in cupolas over the car tracks. The contents of the cars passed through track gratings and were transferred to the east workhouse lofter leg boots via four 40" belt conveyors. Each transverse belt served one of the house lofters. The belts from pits No. 1 and No. 4 ran at 660 fpm and were driven by 15 hp motors; operating speed for belts No. 2 and No. 3 (which were shorter) was 653 fpm with motors rated at 7-1/2 hp. In 1971, three years prior to the closing of the Ganson Street plant, three car pits remained in service and power shovels for emptying boxcars were still in use at two of the receiving pits. The third pit may have been dedicated to receipts from hopper cars.

For elevating grain arriving by rail at Elevator "A", the east workhouse was equipped with a total of four lofters, each carrying a double row of 14" x 8", 8" deep Superior buckets. The lofter leg boots featured the Edmonds automatic pick-up. The lofters were driven at the head pulley by 125 hp motors through Foote Bros. helical reduction gearing and Morse Chain flexible couplings. These legs discharged into four sets of steel garners and scales, the capacity of the scale hoppers being 2,500 bushels. The Fairbanks scales were solid-lever Type S models, capable of weighing up to 150,000 lbs. in a single draft. A scale could be calibrated for adjustment in increments as small as five pounds.

Following elevation and weighing in the east workhouse, provisions for distribution of grain and feedstock among elevators "A", "B" and "C" were rather involved. Spouting on the distribution floor of the east workhouse was arranged for delivery to storage bins in Elevator "A" or to the three reversible conveyors running longitudinally over the bin floor. Both the north and south belts were 42" inches wide with 20 hp motors; the center conveyor was 40" in width with a 25 hp motor. All three conveyors were designed to operate at 660 fpm. The trippers on these distribution belts travelled up and down the length of the conveyors through a worm-and-friction drive; each was equipped with two-way spouts for discharging to bins. Instore shipments of grain, such as corn which might require conditioning, could be spouted to a series of square bins situated in the east workhouse below the bin floor. These smaller bins presumably supplied cleaning machinery of undetermined make and capacity. Once cleaned, grain was reelevated for distribution to storage or transfer to the mill.

It was also possible to transfer grain from Elevator "A" to the former Wheeler Elevator and vice versa. Three of the four lofter legs in the east workhouse of Elevator "A" apparently could be cross-spouted into the Wheeler; conversely, both the Wheeler lofters linked up with lofter No. 1 in the 1941 addition. Grain in Elevator "C" could also be received from and shipped over to Elevator "A" through the Wheeler. These routes would have utilized the conveyor gallery connecting the Wheeler headhouse with the bin floor in "C" and its distributing apparatus, the two basement belts in the 1936 structure, and the lateral transfer belt from the west end of "C" to the Wheeler basement with its outstore conveyors. Since the 1936 addition apparently lacked lofter legs, grain could only be moved in one direction between the Wheeler and Elevator "C".

Shipping by Water, Rail and Land

The Wheeler Elevator was originally designed for deliveries to barges, canal boats, rail cars or local wagons. The basement contained a pair of shipping conveyors running the length of the structure. Some pictorial evidence suggests that these outstore belts could be loaded from cross belts--an unusual arrangement in Buffalo elevators with rectangular footprints. The longitudinal shipping belts carried grain to the boots of the house lofters for reelevation and weighing in the 500-bushel outstore Buffalo scale. Vessels could be loaded through a single dock spout located at the east side of the marine tower/workhouse. Cars were loaded under a small canopy on a single track at the south side of the elevator through a long spout descending from a point below the bin floor of the workhouse. Initially, cars could be loaded at the rate of ninety over ten hours. As of the 1920s, both water and rail shipments were loaded at a rate of 10,000 bu./hr. In the three-bay loading shed between the Wheeler and the site of Elevator "A", two bays were served by loading spouts from the Wheeler headhouse; a third spout delivered from the east workhouse of "A". Prior to the construction of Elevator "A", shipments out of the Ganson Street complex, including the feed mill, averaged 100 cars per day.[31]

The original layout of Elevator "A" concentrated rail shipping functions in the west workhouse. Three 40" basement conveyors, driven by 25 hp motors, operated at 675 fpm. The center belt ran through the east workhouse, presumably to handle grain from the conditioning machinery; interspace bins also spouted to this belt. Since the three basement conveyors all converged on the single lofter in the west workhouse, cross belts were required to transfer grain from the north and south outstore belts to the leg's boot tank. The 40" cross belts were driven by 5 hp motors and operated at 675 fpm. The west lofting leg featured a double row of 14" x 8", 8" deep Superior buckets comparable to the legs in the east workhouse and elevated grain to a single garner-scale set. The capacity of the outstore scale was 2,500 bushels.

Unlike the east workhouse, there was no distribution floor beneath the scale hopper. Instead, the turnhead on the bin floor fed into a single car spout that lead to a loading shed on the south side of the west workhouse. This turnhead also served the transverse conveyor which ran in an overhead gallery leading to the feed mill. The carloading spout could be supplied from the western end of the south instore conveyor located on the bin floor. The car spout terminated in a bifurcated Sandmeyer-type attachment for directing grain into both ends of a boxcar simultaneously. Outstore grain could be transferred to the adjacent feed mill via a conveyor bridge containing a 40" belt that was loaded from the north and central bin floor belts. A 25 hp motor drove the transfer belt to the mill.

Marine shipments, carried on at a nominal rate of 15,000 bu./hr. during the post-World War II era, were discontinued by Agway prior to the close of its operations. Over the same period, rail loading capacity through two active spouts had dropped from 15,000 bu./hr. to 10,000. Considerable provisions also existed to accommodate truck traffic. The receiving rate from vehicles using a converted car pit was 20,000 bu./hr. The loading rate utilizing one of the car spouts was 10,000 bu./hr.

ENDNOTES

1. The following paragraphs are based on information from several sources including city building permits and plans housed in Buffalo City Hall. Details of capacities, reinforcement and completion are described in American Elevator & Grain Dealers Journal, 28 (15 October 1909): 218 and 27 (15 May 1909). Similar information is related in the Buffalo Express of 2 May 1909. An article from the Buffalo Live Wire pasted in the "Buffalo & Erie County Library Harbor Scrapbook," Vol. 1, 329, quotes interesting figures relating to construction rates. Details of the

foundation work for GLF "A" are recorded in the Engineering News Record (20 November 1941): 65.

2. Buffalo and Erie County Public Library (BECPL), Scrapbooks, "Buffalo Harbor," Vol. 1, p. 338.

3. BECPL, Scrapbooks, "Buffalo Harbor," Vol. 1, pp. 338-39.

4. Erie County Clerk (ECC), Corporations, Wheeler Elevator Company, "Certificate of Consent to Mortgage," March 1, 1991, Box 11932. All Erie County Clerk documents are listed by date of document origin, not by date of filing, unless otherwise noted.

5. BECPL, Scrapbooks, "Buffalo Harbor," Vol. 1, p. 338; Beeson's Marine Directory (Chicago: Harvey C. Beeson, 1915), 218.

6. ECC, Corporations, Wheeler Elevator Company, "Certificate of Dissolution," January 24, 1917, Box 11932; Deeds, Liber 1382, February 7, 1917, 356-57.

7. Northwestern Miller (13 March 1920).

8. ECC, Deeds, Liber 1881, May 6, 1926, 460-61; Liber 1892, May 6, 1926, 32.

9. ECC, Corporations, Transit Forwarding Company, Certificate of Incorporation, March 31, 1923, Box 6310; Buffalo City Directory, 1922, 1938.

10. Northwestern Miller (29 February 1928): 829; (2 June 1919).

11. ECC, Corporations, Cooperative GLF Exchange, Inc., Certificate of Incorporation, June 22, 1920, Box 18881.

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14. BECPL Scrapbooks, "Industry," Vol. 5, 167; BCH, Permits and Plans, Permit #28084, June 22, 1936, Permit #33017, April 4, 1941.

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17. Business Week (6 November 1943): 52-3; (12 May 1945): 26; American Economic Review, 36 (May, 1946): 451-519.

18. Buffalo Courier-Express, 2 December 1951, Sec. 4, p. 28.

19. Buffalo Courier-Express, 24 October 1953, p. 5; 2 November 1953, p. 24; 3 November 1953, p. 26; 9 November 1953, p. 17; 12 November 1953, p. 1; 14 November 1953, p. 15; 18 November 1953, p. 19; 24 November 1953, p. 1; 3 December 1953, p. 1; 17 December 1953, p. 38.

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21. Buffalo Evening News, 10 March 1964, p. 29; "This is Agway," n.p., October, 1990.

22. Buffalo Evening News, 11 January 1974, p. 29; "This is Agway," n.p., October, 1990.

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24. BECPL, Local History Scrapbooks, "Industry," Vol. 7, 179 (Buffalo Courier-Express, 2 December 1951).

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26. Building Permit #RO52507 (22 June 1953). Henry H. Baxter, "Grain Elevators, Adventures in Western New York History," XXVI (Buffalo: Buffalo & Erie County Historical Society, 1980), 8. Baxter quotes a figure of 50,000 bu./hr., which, even on the dip, considerably exceeded the approximately 30,000 bu./hr. capacities of the marine legs built during the last major wave of waterfront elevator expansion in the 1920s.

27. On the scoopers' strike see Buffalo Courier-Express, 24 October 1953, p. 5.

28. For details concerning the construction of a representative feed mill at Denver during this period see Edmund Wilkes, Jr.,

"Concrete Mill Design Governed by Machinery Layout," Engineering News-Record, 106 (2 April 1931): 561-64.

29. BECPL Scrapbook, "Industry," Vol. 3, 171 (Buffalo Times, 14 February 1932).

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APPENDIX

Elevator "A"

Cost:	$400,000
Foundation:	Concrete caissons 36" in diameter supporting angularly reinforced foundation beams 3' deep and from 3' to 4'-9"; structure incorporates a 9" foundation slab; all reinforcing rods are deformed bar of intermediate grade steel; 5" gravel bed with a 4" floor slab above the foundation slab; floor slab reinforced with a grid of 1/2" round bar at 15" intervals; round bar mortar floor to a depth of 9"
Basement:	Enclosed within bin walls; bins rise from basement slab; free-standing radial basement pillars support concrete ring girder; pillars 1'-4" x 1'-2" x 13'-5" (from floor slab); ring girder has 12-sided interior face and is 3'-6" deep by 2' wide; ring girder not tied into bin wall; basement height 12'-9" from floor slab to ring girder; at grade; lit by 2 upright windows per bin
Hoppers:	Conical steel to full width of bin supported by ring girder; hopper angle 55° (usual angle 36 to 40°); interspace hoppers, concrete slab on rectangular frame of concrete beams tied to bin walls
Bins:	Capacity 1,000,000 bushels Main bins 12 x 3 in parallel rows; cylindrical 19'-8" in diameter; bin height, 108' from foundation slab, 92' from top of ring girder Interspace bins 22 x 2 No outerspace bins Square workhouse bins: 15 in east workhouse, 9'-6" square, 92' high Tangential contacts between all bins Tangential contacts 9'-6" wide longitudinally and 8' wide transversely Wall thickness for cylindrical and square bins 8" at tangential contacts 8" Vertical reinforcement, round, deformed rod of hard grade new billet steel; jacking rods

1" deformed rod of hard grade steel, new billet steel in 4' lengths with sleeve connections; 8 jacking rods spaced equidistantly, including one at the center of every tangential contact; jacking rods augmented by 12 ordinary verticals on exterior walls, and 8 ordinary verticals on interior walls; all verticals centered 3-1/2" from outer surface of wall
Horizontal reinforcing, round, deformed rod, of intermediate grade new billet steel in graduated sizes at fixed course intervals
Horizontals wired to outside of verticals

Bin Floor: Non-monolithic concrete; individual concrete bin tops

Gallery: Monolithic concrete

Workhouse: Monolithic concrete, smooth finish, internal piers

REFERENCE: Army Engineer microfiche of the original drawing and contract housed in Buffalo City Hall. City building permits provide dates and City Plans Book 1941 costs. Details of the foundation work are recorded in Engineering News Record (20 November 1941): 65.

Elevator "B"

Cost: $148,000

Foundation: Wooden piles and concrete foundation slab

Basement: Full height (15') above grade, rectangular pillars support an octagonal network of basement beams; straight exterior walls with a panelled effect achieved by an infilling of rusticated concrete block between exterior pillars; rusticated panels pierced by upright windows

Hoppers: Flat plate steel to full width of all bins supported by the network of basement beams

Bins:	Capacity 700,000 bushels Main Bins 5 x 3 in parallel rows, cylindrical 25' on 25'-10" centers, 80' high (from top of basement beams) Interspace bins 2 x 4 10 outerspace bins formed by convex 1/4 walls between main bin walls All intersections tangential Bin walls 8" thick, 12" at intersections Vertical reinforcement: 28 rectangular bars per main bin, 5 per 1/4 wall, all on 3' centers Horizontal reinforcement: graduated rectangular bars in 12" courses
Bin Floor:	Open-topped bins
Gallery:	Structural steel clad in corrugated iron Pitched roof over open bin tops and monitor for conveying machinery
Workhouse/ Marine Tower:	Structural steel clad in corrugated iron

REFERENCES: The original plans filed at Buffalo City Hall have been lost. Plans filed for GLF "C", 1936, and GLF "A", 1941, provide many of the above details. City building permits provide dates and City Plans Book for 1909 costs; <u>American Elevator & Grain Dealers Journal</u>, 28 (15 October 1909): 218 and 27 (15 May 1909) includes details of capacities, reinforcement, and completion. Similar details are related in <u>Buffalo Express</u>, 2 May 1909. <u>Buffalo Live Wire</u>, pasted in Buffalo & Erie County Library Harbor Scrapbook, Vol. 1, 329, quotes interesting figures relating to construction rates.

<u>Elevator "C"</u>

Cost:	$50,000
Foundation:	Wooden piles capped by 3' foundation slab, reduced to 1' where no pile; foundation slab covered with 14" gravel bed for 4" floor slab

Basement:	Enclosed within bin walls; bins rising from basement slab; free-standing radial basement pillars support concrete ring girder; pillars 1'-2" x 1' x 10'-6"; ring girder has 12-sided interior face and is 3'-6" deep by 3'-6" wide Girder reinforced with hoops of ½" rod on 16" centers and by 7 straight, non-trussed horizontal rods, 2 on top, 1 on each side at 1/2" and 3 on the bottom; ring girder not tied into bin wall; basement height 8'-9" from floor slab to ring girder, 2/3 above grade Lit by 2 upright windows per bin
Hoppers:	Conical steel to full width of bin supported on ring girder; hopper angle 45° (usual angle 36-40°)
Bins:	Capacity 170,000 bushels; main bins 3 x 2 in parallel rows; cylindrical 21' in diameter; bin height 99'-9" from foundation slab; 85' from top of ring girder 2 interspace bins; no outerspace bins tangential contacts transversely; non-tangential contacts longitudinally by straight link wall; tangential contacts 9'-6" wide; link walls 2'-6" long; bin wall thickness 8" at tangential contacts 10"; vertical reinforcement, round deformed rod of intermediate grade, new billet steel; jacking rods 1" round, smooth, and of hard grade, new billet steel; verticals centered 3-1/2" from outer wall surface; horizontal reinforcing, round, deformed rod of intermediate grade in graduated sizes at fixed course intervals
Bin Floor:	Monolithic concrete
Gallery:	Monolithic concrete

REFERENCES: Army Engineer microfiche of the original drawing and contract are housed in Buffalo City Hall. City building permits provide dates and City Plans Book for 1936 costs.